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THE
AGRICULTURAL LEDGER.

1904—No. 7.

INDIAN BEES'-WAX.

(APIS DORSATA, etc.)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. I., B. 392-415.*]

AN ACCOUNT OF THE SOURCES, PREPARATION, TRADE AND COMPOSITION OF THE BEES'-WAX OF BRITISH INDIA.

By DAVID HOOPER, F.C.S., F.I.C.

Other DICTIONARY article that may be consulted :

Honey and Bees'-wax, *Vol. IV.*, H. 341-359.

CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA.
1904.

H

Price 4 annas or 4d.

The objects of THE AGRICULTURAL LEDGER are :—

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(2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India, so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept;

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All papers published will be paged, irrespective of subjects, into an annual volume. The annual paging will be given on the top of the pages. But to permit of continuation of the classification into the various series hitherto observed a further folio will be shown at the bottom of the pages. This will be preserved throughout each series and be continued for several years, until in fact sufficient material in each series has been accumulated to constitute a fair sized volume.

At the end of the year a printed index and title-page will be issued for the annual volume, and after a period of, say, five years an index and title-page will be issued for each series. It has been found that many persons subscribe for a certain series only and do not care to receive the others. The new arrangement, while permitting of the formation of an annual volume, will at the same time retain the serial classification.

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AN ACCOUNT OF THE SOURCES, PREPARATION, TRADE AND COMPOSITION OF THE BEES'-WAX OF BRITISH INDIA.

By DAVID HOOPER, F.C.S., F.I.C.

INTRODUCTION.

An enquiry into the subject of Indian bees'-wax was instituted by the Reporter on Economic Products to the Government of India in 1893. The following letter from the Officiating Reporter addressed to the Inspector General of Forests, (No. 339, dated Calcutta, 16th October 1893) will explain the circumstance under which the investigation was undertaken:—

"At the request of the Secretary of State, insect-waxes (*viz.*, bees'-wax and white insect wax) have been included among the products of which detailed collections are to be made, and hand-books written, in connection with the Imperial Institute; and I should be very grateful for any assistance in carrying out the enquiry which can be rendered through the medium of the Forest Department."

After referring to the exports of bees'-wax during the five years 1885-1892, and the countries to which it was exported, the letter continues—

"Bees'-wax is said to be brought to Calcutta from the Sundarbans, Western Bengal, Orissa, Behár, North-Western Provinces, Assam, and

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INTRODUCTION.

Nepal. The best qualities are reported to come from Orissa, Western Bengal, Sylhet, and Nepal.

"I should be very grateful for specimens, if possible, of the bees (preserved in alcohol) and of wax (about 10 lbs.) from different localities, and for any information which may be obtainable under the following heads:—

1. By whom the combs are collected.
2. Place of collection.
3. Method of collection (*e.g.*, from hollow tree trunks, crevices of rocks, etc.).
4. Abundance of supply.
5. Extent of export of wax.
6. Method of preparation of wax. (In some places the combs raised in villages are said to contain a large quantity of sticks, moss, leaves, etc., which are easily removed by stirring powdered borax with the molten wax.)
7. Price of combs with honey, and of the wax.
8. Whether bees are domesticated."

This letter was circulated by the Inspector General of Forests to the Governments of Madras, Bombay, Bengal, North-Western Provinces and the Panjáb, to the Chief Commissioners of the Central Provinces, Burma, Assam, Coorg, and Ajmir, and to the Chief Officials of Hyderabad, Port Blair, and Baluchistán. The Conservators of Forests in these Provinces were instructed to furnish specimens and information to the Indian Museum. During 1894 and 1895 a ready response was made to the circular by all the Forest Officers concerned, and a considerable amount of information became available on the subject of Indian bees and the economic value of their products.

The present number of the *Agricultural Ledger* is accordingly prepared from official documents in the office of the Reporter on Economic Products, and an opportunity has been taken to make the subject more complete by submitting to chemical examination some of the various samples of bees'-wax collected in different districts and deposited in the Industrial Section of the Indian Museum.

The species of bees described in this report were, when possible, identified by Major A. Alcock, F.R.S., and Mr. E. C. Cotes of the Indian Museum, and this opportunity is taken to thank these officers for their courtesy in this respect.

After describing the peculiarities of the bees, the centres of the wax and honey trade in India are discussed in the following pages, the methods of preparing the wax and its local uses are referred to, and finally a report is made on the character and composition of the various denominations of bees'-wax of the country.

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THE INDIAN HONEY-BEES.

Apis dorsata.

Apis dorsata, *Fabr.*

THE HILL BEE.

Vern.—*Vowra,* HIND.; *Khago, bheer mohury,* BENG.; *Lywai,* ASSAM; *Dangara, dingar, sarang, bhural, mahal,* U. PROV.; *Bhavra, bhcr, mohal, bhawura, mahook,* CENTRAL PROV.; *Mahal,* PB., *Age, aghya, agya, bhawar, bhammar, bramuar, konge, konege, ghangal, katámbé, hejjen, togri,* BOMB.; *Tagara, heddájenuhula,* KAN.; *Peddapera, kondaténiga, pedda egalu, perai-egalu,* TEL.; *Periathem, malai teni, perumthene,* TAM.; *Pya gyi,* BURM.; *Bambera,* CINGH. Bees are commonly called *Shahd-ki-makhi* (Hind.), or *modhu makhi* (Bengal), meaning the " honey fly."

This bee is found all over India, but not at great height above sea level. It is said to be found at 2,000 feet or more in Bhután and 3,000 feet in the Shán hills, but may justly be termed a tropical insect indigenous to the plains.

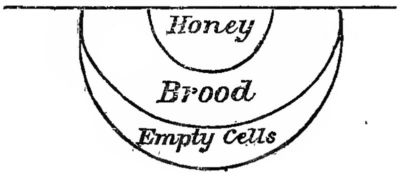
Description.

A. dorsata is the largest Indian honey-bee. It is about one inch long, marked with yellow or light brown stripes, and has thirteen rows of bristles forming the pollen basket. It builds cells to the number of 4½ to the inch. The combs are built exclusively in the open, on the underside of the branches of large trees, in caves or under overhanging rocks, and in old buildings. **Dr. Forel** says this bee seems to have a great liking for the buildings of old Mogul Emperors, as it is found in the mosques of Fatehpur, Síkri, Secundra and Delhi. It is very partial to the *Semul* tree (**Bombax malabaricum**), *Anjan* (**Terminalia Arjuna**), *Bar* (**T. belerica**), *Pipal* (**Ficus religiosa**) and **Mangifera indica**. In Burma it attaches itself to the *Kanyin* (**Dipterocarpus lævis**), *Thitpok* (**Dalbergia purpurea**) and *Letpan* (**Bombax malabaricum**).

Size of combs.

The combs are three to five feet long and two feet or more deep. The brood comb or lower portion containing the larvæ is about 1¼ inches thick, the upper portion or store comb is much thicker and contains the honey. Some of the combs weigh about half a maund, others are too heavy to be carried by one man. An average comb gives from 10 to 20 lbs. of honey and from 2 to 3 lbs. of wax.

A diagrammatic sketch of the comb of **A. dorsata** is represented below—



THE INDIAN HONEY-BEES.

Apis dorsata.

The reasons against any attempt to cultivate this species in a hive are—(1) The bee builds naturally in the open. (2) It builds normally only one comb, so that the honey cannot be removed without removing the brood also. (3) Although it builds a very large comb, this comb is not so great in cubic capacity, normally as the combs built by a stock of **A. mellifica** which is readily cultivated and the habits of which are well understood. (4) It is only found in a tropical climate, and in this respect differs from **A. mellifica** and **A. indica,** the most productive varieties of which are indigenous to localities having more or less severe winters.

This large bee when disturbed attacks men and animals and it has a reputation of being a vicious insect, but unless disturbed it does not attack, and can be handled by some of the measures usually employed by bee-keepers.

Apis indica.

Apis indica, *Fabr.*

THE TREE BEE.

Vern.—*Satpada,* HIND.; *Mohury,* BENG.; *Aira, doar, khera, door,* U. PROV.; *Doyer,* PB.; *Sadhi, satde, sateri, sative, satar, satree* MAR.; *Kol,* BOMB.; *Sathpuria, satha,* CENTRAL PROV.; *Tudir-jen, tudri-jen, tudabi nona,* KAN.; *Aduku theni, kosumtheni,* TAM.; *Thorrá egalu, pullaténiga,* TEL.; *Pya aung,* BURM.; *Lehej,* ADEN.

Description.

The bees of this species agree with **A mellifica** in having nine rows of bristles to the pollen baskets, and in the division of the anterior wings, relative position of the eyes, in building drone comb, and in the drones being widely different to the workers in shape. In fact, as described by entomologists, they differ from the European honey-bee mainly in size and colour, being smaller and darker. The size is about ½ inch, and with black and brown stripes on the lower half of the body.

This bee builds cells to the number of 5½ to 6 to the linear inch. The Bhutan variety builds larger cells, and more comb, and is not so prone to sting than the varieties met with in the plains. This kind, therefore, has offered advantages to Europeans living in hill-stations to cultivate and hive them successfully. The bee of the plains is considered to be economically worthless for purposes of cultivation.

Habitat.

Apis indica, as distinct from **A. dorsata,** frequently chooses hollow trees to build in where it has necessarily to submit to the presence of other insects. It has even been known to share its dwelling with a nest of wasps. It also builds in empty white-ant hills. Colonel Bingham has remarked that in Burma, where the houses are built chiefly of wood, he had more than once seen a house rendered

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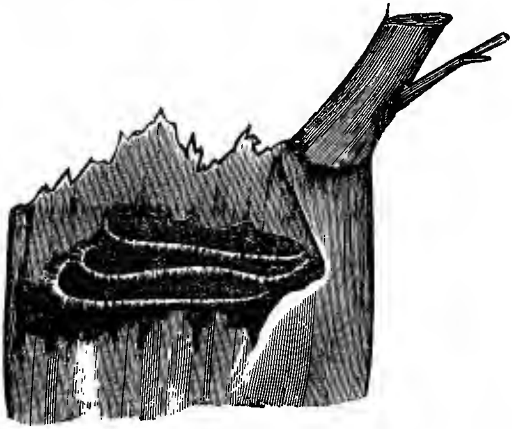
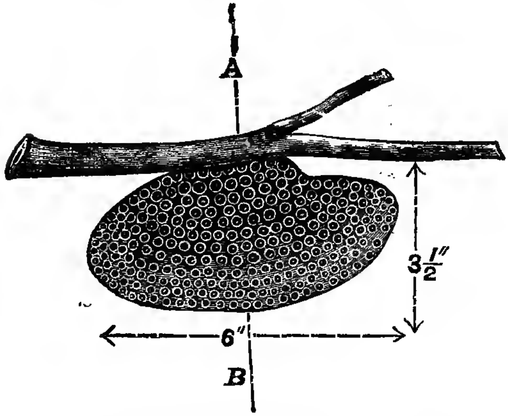
uninhabitable by a swarm of **A. indica** taking possession of the hollows under the wooden stair cases or between the outer walls when these were built.

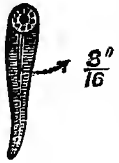
Apis indica.

In the cold weather these bees build their combs in hollow or decayed trees, and the combs are made in layers, one on top of another, often to the number of seven, hence the vernacular name *Sathpuria* or *Satha.* The appearance of an average specimen of one of these nests is illustrated below :—



In the hot weather the combs are built on the branches of trees, and are of the size of a hand or larger. A sketch of one of these combs from Hoshangábád is given below :—





Among a number of *Sateri* bees collected in Belgaum and sent to Major Alcock for identification, a fly named **Eristalis arvorum**

THE INDIAN HONEY-BEES.

was detected. This resembled the bee so closely as to defy detection by a casual observer.

Apis florea.

Apis florea, *Fabr.*

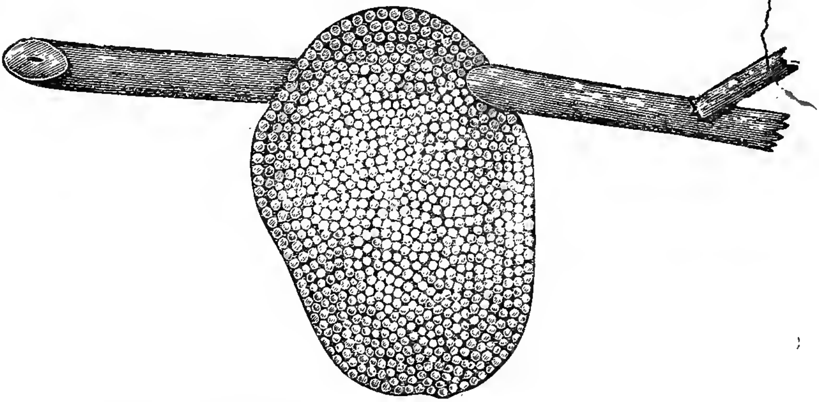
THE FLOWER BEE.

Vern.—*Kátyál,* MAR.; *Sopelia, lamai,* C. P.; *Tudbi, zinya,* BOMB.; *Kol-jen, dubal-jen, kombujenuhula,* KAN.; *Kombuthem, oletheni, shirutheni,* TAM.; *Thodi-pera, pullu egalu, dzuntiteniga,* TEL.; *Cheruténica,* MAL.; *Yin-pya, thit-kaung-byah,* BURM.; *Pushpalit,* SANS.

Description.

This is the smallest species of **Apis** found in India, and is a particularly common bee in the Bombay Presidency. It is very constant in colour, size and shape, being about ¼ inch (8 mm.) in length or somewhat larger than an ordinary house fly. Its worker cells are nine to the inch, and its drone cells about six; the drone is relatively to the worker much larger than the European honey-bee, and has a thick thumb-like projection on the metatarse of the posterior legs. This drone differs also in some other structural respects from that of **A. mellifica.** It is regarded as a stingless bee.

Like **A. dorsata,** this species builds in the open a single comb, and is only found in the plains. Its comb is usually built attached to a branch in the manner shown in the following illustration:—



Habit.

It commonly builds in bushes of a thorny nature, but sometimes under the cornices of houses and inside buildings. The comb is about the size of a duck's egg, at other times it may be as large as a man's hand, or it may be greatly extended and in part duplicated. Another peculiarity about the comb is that it is looped round the bough instead of entirely depending from the lower side as in **A. dorsata.** Near Mandalay combs have been found on bamboos and shrubs of the **Acacia** tribe as *Tanoung* (**Acacia leucophlœa**)

THE INDIAN HONEY-BEES.

Apis florea.

Cutch (**A. Catechu**), *Nantonkiang* (**A. Farnesiana**), and *Soo-yet* (**A. pennata**). The Morhi bee, probably the species under discussion, is found in desolate forests of West Khandesh, where a bush *Khavi* (**Strobilanthes ciliatus**) grows in abundance. The combs are raised in the shrubs when in flower. The bee is about the size of the common house fly and produces good honey.

A. florea is not nearly so plentiful in Burma as are the other two species. **Colonel Bingham** has seen very few nests. One was built in a cane bush not more than a few inches from the ground; another under the eaves of the roof of a forest bungalow.

The honey is small in quantity, and that of the small combs built in the open air is commonly very thin, but that found in large sheltered combs is very superior. The honey and wax of this species are not of commercial importance; they are often collected but seldom offered for sale. With regard to the wax it will be noticed that there is a slight variation in the composition of samples, although the average results correspond with the wax of **A. dorsata** and **A. indica**.

THE DAMMAR BEE.

Melipona.

Melipona (Trigona) spp.

Vern:—*Kúnti, kóte, poyé, nasari, pove*, BOMB.; *Bhinkwa, bhumkua, bhungaira*, UNITED PROV.; *Bankua*, PB.; *Misri, misri-jiga, nasri-jen, sollejenuhula*, KAN.; *Kota, kuntali, lokhra*, CENTRAL PROV.; *Nasri theni, kosutteni*, TAM.; *Musuru-téniga, Musari egalu*, TEL.; *Moye byah*, BURM.

Several species of these minute, stingless bees occur in India and Burma. They are about one-eighth of an inch long, and are sometimes called the "Mosquito bee" and "Dammar bee."

They build their combs in the walls of houses, in holes in the ground, and in hollows of trees. The entrance to the hive is generally projecting like the mouth of a bugle made of a soft sticky wax. When the nests are small the wax is not regularly collected, but from large combs the peculiar black sticky wax said to resemble chewed resin or cobbler's wax is used for many purposes.

In the Central Provinces the wax of the *Kota* bee is sold at the low rate of 2 to 4 annas a seer, because it is darker in colour and more sticky than ordinary yellow bees'-wax.

Honey.

The honey of these bees is often tainted with a peculiar odour and bitterish and acid taste, and has a considerable reputation in many parts of India for its medicinal properties. In Nellore the honey is regarded as intoxicating.

Wax.

In Burma the dammar-bees are of some importance in yielding a peculiar resinous wax known as *Pwé-nyet*, and a note by **Colonel Bingham** on the subject may be read in this connection with some interest.

THE DAMMAR BEE. Melipona.

"The dammar-bees, as the species of this genus are sometimes called, are widely spread, being plentiful in South America and in the Oriental region. All the species known to me build their nests in hollows of trees, crevices among rocks, sometimes in holes in stone walls. **Horne** (*Trans. Zool. Soc.* vii, p. 185) gives an interesting account of the finding of the nest of **Melipona (Trigona) ruficornis,** *Smith*, and states that the hollow in which it was built was coated all over with a layer of black wax, and that the cells, containing a dark honey of excellent flavour, were globular in shape, pendent side by side from the roof. In 'Science Gossip' for 1866, p. 198, the **Rev. C. S. P. Parish,** then chaplain of Moulmein, gives an excellent description of the nest of **Melipona (Trigona) læviceps,** *Smith,* a fairly common species in Burma. He mentions the extraordinary trumpet-shaped structure of resinous wax, which very often forms the entrance to the nests of the dammar-bees, projecting from the hole in the tree for a foot or more. The resinous product collected and used by the bees in making their nests is called 'Pwé-nyet' by the Burmese, and after boiling in water and mixing with earth-oil or petroleum is largely used for the caulking of boats. The right of collecting 'Pwé-nyet' is sold by the Local Government in Burma and Tenasserim yearly, and forms one of the sources of revenue under 'Minor Forest Products' (*in Blanford, Fauna of Brit. Ind., Hymenoptera,* I. 560).

Pwe-nyet. *Conf. p. 99.*

For further information on Pwé-nyet, **Rev. C. S. Parish's** "Letter on the tree which produces Pwai-nyet" may be consulted, which will be found in *Journ. Agri. Hort. Soc. of India,* X. 103-105. Proc. 56.

In Trinidad, species of **Trigona** were observed to carry off the rubber fluid from the stems of **Castilloa elastica,** and the gum-resinous exudation of the **Garcinias,** as a sort of ready made wax for their nests. In some cases they actually cut the bark to cause a flow of the desired fluids.

PREPARATION OF WAX.

PREPARATION OF THE WAX.

The preparation of bees'-wax is a very simple operation and requires no skilled labour. In fact, it is almost invariably performed by the jungle tribes who collect the honey and combs from the trees and rocks. The season for making wax is usually the hot weather, and lasts from April to the middle of June.

As we have noticed in an earlier part of the paper the comb consists of two parts, the upper portion containing the honey, and the lower portion bearing the eggs or brood. The upper part affords a clean white wax, while the lower produces a dirty and coloured substance. As a rule the whole of the combs are detached from

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PREPARATION OF WAX.

the branches and are not separated before being melted. They are first divested of the honey and are squeezed by hand until it is all removed. The comb is then washed in cold water to remove all soluble matter, it is then placed in a brass, iron or earthenware pot or cauldron, half filled with water, and warmed on an open fire. As the wax melts it rises to the surface of the hot water, and the impurities sink to the bottom. The impurities consist of the larvæ, dead insects, twigs, leaves, grass, chips of wood. The pot is then removed from the fire and after being allowed to cool, the wax is taken out and made into cakes or balls. If the wax still contains impurities it is remelted and strained through a piece of coarse cloth or blanket (*kambli*), and the melted wax received in a pan or plate containing cold water.

Methods of clarifying.

In a few districts some peculiar methods are adopted to purify or clarify the wax. For instance, in Betúl, Central Provinces, the wax is put into a jar of liquid cow-dung for one night, it is then washed and again heated and strained through cloth. This operation is supposed to make the wax very clear. In the Nellore district, Madras, when the melted wax has reached its boiling point, a handful of Tamarind leaves is thrown into the vessel; this addition is said to precipitate all the foreign matter and furnish a very pure product. Salt is sometimes used in the water in which the wax is boiled, but, as a rule, no chemicals such as borax are employed in the clarifying process.

Artificial colouring.

Then to give the finished wax a golden yellow colour it is mixed with *Haldi* or turmeric, the powdered root of **Curcuma longa.** It is surprising how universally the artificial colouring with turmeric is practised. In Bombay and Madras and throughout Burma this colouring agent is frequently added at the last stage of manufacture.

Bleaching.

The bleaching of wax does not appear to be attempted by the native tribes, although the conditions in India are so suitable. If exposed to the sun in thin layers for a week, most forms of bees'-wax will become completely bleached. White wax is not appreciated in the native markets, so turmeric is employed to improve on the natural pale colour and enhance its commercial value.

Moulding.

Yellow wax is sold in various shapes according to the district. In Nimár and Ganjam it is made into round balls of about half a pound or one pound in weight. The Madras market prefers wax in the form of cakes of one foot in diameter and 1 or 1½ inch in thickness. In the Kurnool district the wax is moulded in blocks of two feet in diameter by 6 to 9 inches in thickness, or the size of a "ten pound wedding cake." The moulds for these cakes are usually pits dug in the ground lined with liquid cow-dung, and are constantly used for this purpose in many districts in Bombay and

PREPARATION OF WAX.

Madras. The largest blocks of wax on the market are those made in the Lower Chindwin Division, Burma, where they are moulded into masses of 8 viss (29·2 lbs.) each.

Moulding.

If for export to Bombay, the collectors in South Kanara strain the melted wax into square wooden boxes. In Burma hollow bamboos are utilized for melting and moulding bees'-wax into cylindrical blocks; either the clarified melted wax is poured into a bamboo joint and allowed to solidify, or, as in the Kátha Division, it is prepared in the bamboo. The Conservator of Forests, Kátha, thus describes the process. A joint of a large bamboo is cut so as to have one end closed. In this a little water is placed, on top of this a thin layer of strips of split bamboo, and wax above this; the whole is then put on the fire. The steam causes the wax to melt and run through the filter and collect at the bottom. When cold, the bamboo is split up, and a mass of pure wax is found in the interior.

Adulteration.

It does not appear that any systematic adulteration is practised by those who prepare bees'-wax for the local Indian markets. In one district in the Panjáb it is said that after cooling the strained wax, one-eighth of its weight of oil of *til* (**Sesamum indicum**) is added before it is made into lumps for the market. The addition of oil would render the wax more plastic and perhaps give it a consistence suitable for local requirements.

Most of the samples collected for the Indian Museum were fairly clean, but a large proportion would have been greatly improved with a second remelting and straining. Very few districts supply refined bees'-wax, and when it is refined by the *banyas* in large towns opportunities are given for adulteration which are occasionally not neglected. In the collection of samples to hand from Indian districts it will be seen that the most flagrantly adulterated bees'-wax comes from Bombay where it is supposed to have been imported from European sources.

CENTRES OF TRADE Bengal.

CENTRES OF TRADE.

BENGAL.—In the Sundarbans, where large quantities of honey and wax are collected through the Forest Department, the combs are taken by a class of Badgis called Moulays or honey-men. Other tribes in Bengal engaged in the trade are the Bharias, Khunjurs and Natuas.

The supply is not large in Singbhum but the industry is capable of great development. It has been estimated that from 3 to 10 maunds of wax could be collected from a range of 150 square miles in this division. It is sold at the rate of 3 to 4 annas per pound by the villagers, while the bazar men sell it for 8 annas per pound or more.

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CENTRES OF TRADE. Bengal.

The amount and value of wax removed by purchasers for the past two years were as follows:—1901-02, 622 maunds valued at ₹2,510, and in 1902-03, 755 naunds at ₹3,023. This shows a decided increase, most of the revenue being derived from the reserved forests.

With regard to honey and wax in the Chittagong district, a report on bees of this locality will be found in the *Indian Forester*, Vol. X. (1884), p. 560.

In Bhután, Nepal and Tibet wax is collected on a large scale and brought into Bengal for sale. It is usually obtainable in the cold season when it is sold in the local markets at an average rate of 5 annas per pound. 315 maunds of wax valued at ₹13,266 were brought from Bhután to Buxár in 1893-94, and was purchased by Marwaris who sent it to Calcutta. This was not an exceptional year, but the figures are quoted to indicate the extent of the trade in this quarter. The price ranges from ₹30 to ₹47 per maund for the raw wax which is clarified and boiled down into large circular cakes for export.

Calcutta prices.

With regard to the price of bees'-wax in Calcutta, the Secretary of the Bengal Chamber of Commerce reported in 1896 that this article was comparatively scarce. It commanded a price ranging from ₹50 to ₹75 per maund. Pure bees'-wax realized from ₹65 to ₹75, and mixed and rough descriptions from ₹50 to ₹62 per maund. It is in great reqnest in the Straits and Java.

More recent information on prices of bees'-wax in Calcutta is quoted from the market reports for April 1904: "₹53 to ₹61 for raw wax, ₹59 to ₹62 for locally refined. The demand for Europe is very limited. Fair demand for Singapore and the Straits."

Calcutta wax merchants.

The following list of firms selling wax in Calcutta was drawn up by the Secretary of the Bengal Chamber of Commerce in 1896:—

Modhusundum Rampersum Bhobuturum Nundy.
Denonath Mookerjee.
Odhor Narain Roy and Nilmoney Roy.
Madhub Chunder Daw.
Dhun Mudhun Shaw.
Megho Shaw.

The buyers and shippers, and more important dealers are—

Messrs. J. E. D. Ezra & Co., Meyers Bros. & Co., S. Manasseh & Co., Ebrahim Solomon & Co., Cania Ramjee & Co., Goculdoss Hunsraj, Chetram Chutterbhuj.

ASSAM.—Most of the wax of this province comes from the hills beyond the frontier, and very little is produced locally.

CENTRES OF TRADE. Assam. Two species of bee are found in Assam, called *Lywai* and *Ngap*. The former is larger than the other and is probably referable to **Apis dorsata.** It builds its hives in inaccessible rocky precipices, and the comb is often half a maund in weight. The *Ngap* or **A. indica** is the smaller bee, not larger than the ordinary house fly, and exists in the jungle.

In the neighbourhood of Cherrapunji, the Khasia villagers (*Wár*) collect honey and wax. Bees are domesticated to a small extent on these hills, and in other places the *Ngap* bee is hived by building a frame in the hollow of a tree trunk about 3½ feet in circumference, and encouraging a swarm.

Sythet. Merchants from Sylhet purchase all the wax from the Khasia Hills, but statistics of annual exports are not available. The wax is only of fair quality, and some consignments are of such low value that they realize only 2 annas per pound.

United Provinces. *UNITED PROVINCES.*—The right of collecting honey and wax in these provinces is leased annually by auction sale to contractors. There is no particular class of men who make the collection a profession, but those having an inclination and skill in the work take it up as a livelihood. About 50 years ago much honey was collected and brought for sale especially at Petwaghar, Kumaon; the wax was also an article of trade. In the Dehra Dun Division collectors come from Sahâranpur. In the neighbouring Kheri Division wax is collected by Kùchbandhias, Nutts and Pásís; the first two castes are rope-makers, and the last chowkidars and small cultivators.

Dehra Dun. Formerly the honey and wax used to be collected from all the forests of the Dun Division, but of late the work has been confined to those in the Eastern Dun. The receipts from this source have also declined in recent years which shows that the supply is not so abundant. One of the causes of the decline in trade is the prohibition to carry torches or light fires in fire-protected areas. The export of wax consequently does not amount to more than a few maunds, the selling price of which is 8 annas per pound.

Kheri. In the Kheri Division honey and wax are gathered in the forests near running streams. Two men are needed to collect; one enveloped in a blanket climbs the tree to which the comb of the Sarang bee (**Apis dorsata**) is attached, provided with a knife and an earthen pot. The other man, also wrapped in a blanket, ignites a bundle of grass and leaves and passes it to the man on the tree who smokes the bees away from the comb, cuts it from the branch, and places it in the pot. The average revenue from the honey and wax contracts in Kheri for five years ending 1893 was R1,392. The average price of wax is 8 annas per pound, and it is supposed that the contractors make at least 50 per cent. profit.

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CENTRES OF TRADE.

United Provinces.

In Sahâranpur yellow bees'-wax from the comb of the **A. dorsata** is sold at 11 annas per pound, the annual trade amounts to several thousand rupees. A white wax imported from Bombay is sold in small quantities at 9 annas per pound.

Central Provinces.

CENTRAL PROVINCES.—The Commissioner of Settlements and Agriculture writing in 1896 says:—"The honey and wax industry is not developed to its full capacity. The minor forests are stated to be capable of yielding at least 500 maunds of honey and 100 maunds of wax a year, but nothing like this quantity is collected. In the Chadgarh tract of this district bees are so common that it is impossible to beat for wild animals in the forest."

Nimar.

As in other provinces, jungle tribes extract the produce from these forests and prepare honey and wax for local consumption and export. In Nimár the wild tribes, Bhíls, Kúrkús, Dhanuks, and Náháls are the collectors. In some of the reserves no honey is collected although the supply is abundant. Ratgarh hill is described in the Administration Report as "a perfect hive of bees' nests." The bees identified in this district were the large kind **(Apis dorsata)**, and a small kind living in hollow trunks of trees (**A. florea**).

Hoshangabad.

About 50 or 60 years ago the collection of honey in Hoshangábád was solely in the hands of the Gonds and Náháls, but lately some enterprising Mahomedans have taken to it as a means of support. The first man who learnt the art and taught it to his co-religionists was a camel driver attached to a European officer's camp. The Mahomedan collectors, being less inured to jungle life, attack the bee-hives in the day time, being afraid of the reptiles and wild beasts that inhabit the forests at night. The Gond collector of honey, called a Bharia or Mavasi, invests his calling with an air of mystery by observing dietary rules before attacking the comb. It requires five or six persons to accomplish the perilous task of removing the combs from lofty and precipitous crags. The most courageous is he who with a smoking torch in his arm-pit has to climb a lofty tree or rock, or suspend himself in the air in a net or basket with the aid of two ropes—one tied round his chest and the other held in the hand for support—in order to ransack the well-guarded hives, and cut away the best portions. The torch is made of a few dry sticks of wood and green leaves, and is called a *taranga* or *bota.* The Náháls, Gonds, and Kúrkús, who work at night, consider the combs to contain more honey on a dark night than when there is a moon. The comb weighs on an average 5 seers and gives ½ seer of wax and 3 seers of honey. The Gonds and Kúrkús occasionally collect honey as food for themselves and families. The Mahomedans who are professional collectors, and numbered 15 in 1894, pay visits to Bhopál where no

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CENTRES OF TRADE. Central Provinces.

restrictions regarding fires exist. In addition to the wax gathered in the district quantities are imported from Nimár and Betúl; on the other hand wax is exported to Bombay and Surát. The trade is, however, limited and the Mahomedans, the largest workers in Hoshangábád, earn only R200 a year.

Betul.

In Betúl the honey and wax is collected by Gonds and Kúrkús, but no reliable statistics can be given regarding the value of the exports. The combs are afforded by the **Apis dorsata** or Bhowar bee, building in large trees as the **Bombax, Terminalia** and Pipal. Fort Bhowargarh is supposed to have taken its name from the fact of these bees building their combs along its precipices. Combs are found all over the district and the supply is abundant.

Chhindwara.

In Chhindwárá there are three honey-producing bees:—(1) *Bhor* (**A. dorsata**); (2) *Maharose*, similar in colour but of smaller size; (3) *Kothïe*, a small bee of an ash colour. The combs of the two former are collected by experienced Gonds, Kúrkús and Bhurias. The supply of combs is limited and the wax is used locally.

Nagpur.

About 500 lbs. of wax are taken out of the Government forests in the Nagpur-Wardha Division by Gonds, Pardhans and Gooras. The greater portion is consumed locally. One Forest Officer gives his opinion that Wardha is the best district in the Province for honey and wax. **Apis dorsata** and **A. florea** have been sent from Nagpur, their combs are found in trees growing near river banks.

In the Chanda district it is estimated that the total annual yield of these products from Government forests alone amounts to 1,000 seers of honey and 300 seers of wax.

Damoh.

In Damoh, forest products, including wax and honey, are collected by Rowats, Sours, Gonds, Konders, Bhomias, Kheroas, Bherias, Kots and Bhíls. It is estimated that 2,500 to 2,600 combs are gathered annually, and 4 or 5 maunds of wax exported.

Mandla.

There are two seasons for collecting honey in the Mandla district, *viz.*, April and May, and November and December. Baigas and Gonds gather the combs which belong to four bees called Mohras, Kanis, Kuteas, and Bhanwars.

Jabalpur.

Jabalpur district contains very few bees' nests, probably on account of the scarcity of water in the neighbourhood.

Raipur.

In Ráipur, collections of combs are made by Kharwars and Binjhwars, those of **Apis dorsata** and **A. florea** affording the largest quantity of honey and wax.

Sambalpur.

Sambalpur combs are collected by Kols, Konds, and Gonds, wild tribes living in and around the jungle. The principal localities affording honey and wax are the Bamra forest, Rehra Khol, the Gad Laising Zemindary, Ráigarh and Borasamber.

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Central Provinces.

A rough estimate of the outturn of bees'-wax from these places is given in the Annual Report of the Forest Department. Bamra 50, Rehra Khol 40, Gad Laising 20, Ráigarh 40, Borasamber 30, total maunds 180. The wax is not consumed locally but is exported, probably to Cuttack and Calcutta.

The following are the rates for wax about 10 years ago in different districts of the Central Provinces :—

		As.	
Ráipur.	White Wax	10	per pound.
	Yellow "	8	" "
	Dark coloured	6	" "
Nagpur, Nimár and Chhindwárá		4	" "
Hoshangábád		6—10	" "
Sambalpur		12	" "
Betúl		6	" "
N. Circle, about		8	" "
Barra bees'-wax (**Apis dorsata**)		3—6	" "
Kota bees'-wax (**Trigona sp.**)		1—2	" "

Panjab.

PANJAB.—In the Hazárá district the domestication of bees seems to be confined to the higher parts of the district, in the valleys of the Kanhar and Siran, where it is practised by the Sayads and their tenants ; the villagers adjoining the forests of the Dungagalli range also capture and domesticate bees.

In the Jhelum, Chamba, Kángra, Kúlu and Bashahr Divisions it is reported that the zamindars themselves are in the habit of keeping bees. It would appear from the figures given below that in Bashahr and Chamba only is the practice carried on to any large extent.

Where collected.

Place of collection.—This is generally in the forests from hollow trees and crevices in rocks. In Hazárá "Swarms are easily captured in spring and removed from hollow trees to the zamindars' houses in bags smeared with honey and paste "—Bee-keeping here is, however, "entirely resorted to for the honey."

In Chamba swarms are obtained by putting "hives made of hollowed logs of some species of **Rhus** in selected spots in the jungles, or by attracting swarms to hollows left in the walls of the houses."

In Kángra the bees are kept in "hives formed of mud and boxes in the walls of the houses, or hives built on the branches of trees."

Much the same is reported from Kúlu, Bashahr and Simla.

Collection.

Method of collection.—Generally the honey and wax is obtained by smoking out the bees which are driven alternately to opposite ends of the hive "whilst combs or parts of the one comb are removed at either end." Occasionally, as in Kángra, zamindars wait till the bees have abandoned a hive in a hollow tree, the branch containing it is then cut down. In Hazárá the operation of removing the honey is

CENTRES OF TRADE.

Panjab.

carried out in November. In Kúlu it is done twice a year in July and October, and this is also the case in Chamba where the seasons are May or June, and September or October.

Trade.

Abundance of supply and extent of export.—Hazárá.—As noted above, bee-keeping is here only carried on for the sake of the honey. There is no trade in wax. It is, however, to a small extent purchased by shop-keepers in the Gallis. Hives contain from 20 to 40 lbs. of honey and 2 to 4 lbs. of wax—It is estimated that not more than 120 lbs. is exported annually to Rawalpindi.

Jhelum.—Wax occurs only in very small quantities; there is no export.

Chamba.—Nearly all the honey which is collected is sold to traders from Kángra and elsewhere, the quantity exported is believed to be about 1,600 cwt. and 100 cwt., for honey and wax respectively.

Kángra.—Apparently 2 or 3 maunds of wax are used locally in forming moulds for brass work, etc., while 6-7 maunds are exported.

Kúlu.—There is no regular trade in the wax, and the zamindars often use it themselves; the export may be taken at between 2 and 3 maunds. The quantity taken from one hive varies from 6 seers downwards.

Bashahr.—The annual outturn of wax from all sources is about 20,000 lbs., and nearly all this is disposed of at the Rampur Fair, and finds its way to the plains.

Simla.—The supply is very limited, there is no regular trade.

Ambála.—Very small supply of honey, and export *nil.* Wax is not prepared and the honey even is not sold.

Multán.—Very small supply and no export.

Fresh honey-comb yields some 5 per cent. of wax and 90 per cent. of honey.

The wax is sometimes obtained by skimming the surface or dipping into the mixture a cold lota. Another description of the method is as follows:—

The honey is first strained through a sieve, the remaining part is then boiled and strained through a cloth when the cleared wax collects on the top of the water, when cooled, it is taken off and formed into pieces weighing 2 lbs.

Prices.

Price.—In Hazárá the gallis wax is sold at 3-5 lbs. per R1.

Jhelum.—Combs are not sold, but pure wax fetches 1 lb. per rupee, or 1½ lb. per R1 when adulterated with fat.

Chamba.—Wax 1¼ to 1½ seers per rupee, about 10 annas per pound.

Kángra.—There is no honey sold in this Division. Wax is valued at from 1½ to 2 seers per rupee, or 5⅓ annas to 4 annas per lb.

Kúlu.—Wax 1 to 1½ seers per rupee, or 6 to 8 annas per pound,

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Panjab.

Bashahr.—4 lbs. per rupee for wax, or 4 annas per pound.

The bees appear to be domesticated in most hill districts, such as Simla, Bashahr, Kúlu, Kángra, and Hazárá. It, however, appears that in most places the bees are captured in the forest and endeavours have been made to make them remain in the hives prepared for them.

Varieties of bee.

The following information is available regarding the kinds of bees found in the Panjáb :—

In Hazárá a little brown bee (probably a variety of **A. indica**) is the one most commonly domesticated.

In Chamba there are 3 varieties said to be domesticated :—

(*a*) "Paruu" which is the best domesticated variety and gives the best honey.

(*b*) "Dharoou," rather more savage, and honey not quite so good.

(*c*) "Thâmoon," very savage, honey moderate, and builds only a conical or cylindrical comb.

In Kángra two kinds of bees are distinguished, "Bhanour" and "Darola." Both are wild. The latter is to a certain extent cultivated by the zamindars in the hill villages; it keeps apparently exclusively to the high hills. The former appears not to be abundant and keeps continually moving, staying on the hills during the hot weather and migrating to the forests in the valley at the commencement of the rains.

Kashmir.

KASHMIR.—The bee of Kashmir (*manchtilr*) is almost domiciled; it is a little smaller than that of Europe, though a little larger than the domesticated bee of Kumaon. Nearly every farmer has provision in his house for hiving these bees, consisting of small hives, often to the number of ten, built in the upper portion of the walls. About the end of September or the beginning of October is the best time for taking the honey, which is used largely in place of sugar for mixing with food or preserving fruits.

Rajputana.

RAJPUTÁNA.—In Ajmere-Merwara combs are collected by the Bhíls who obtain the contract from the Forest Department, paying a certain amount in cash for the honey and a certain amount of wax fixed at the time of the contract. It is collected from Todgarh, Dewari, Ammer, Baojari and Mandlan ranges, often from huge precipices. The supply of wax is not abundant, about 1½ maunds only, of which the contractors take half as the cost of collecting.

Baluchistan.

BALUCHISTÁN.—Efforts to collect samples and information concerning bees and bees'-wax in this province have been fruitless; nothing could be gained in the jurisdiction by the Deputy Conservator of Forests. This statement is substantiated by a note in a recent number of the *Journ. Nat. Hist. Soc. Bombay* (Vol. XV. No. 2360).

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Baluchistan.

Major C. G. Nurse, of Quetta, writes:—"The **Apidæ** are numerous, both in species and individuals, but I have never come across a specimen of the true honey-bee (**Apis**) (in Baluchistán) though three species occur in India."

SIND.—No samples also were received from Sind and Karáchi.

Kuram Valley.

KURAM VALLEY.—Dr. J. E. T. Aitchison remarks:—"In every village near the hills in this country bees are largely kept by the people, honey and wax being important articles of traffic. Honey is used in place of sugar which is very expensive."

Bombay.

BOMBAY.—Visitors to the caves of Elephanta and Salsette are often disturbed by the bees that frequent the roofs of those historic monuments, and those arriving from England early become acquainted with the fact that honey and wax are not wanting in India.

Forest officers in various districts of the Presidency have contributed useful information on the kinds of bees peculiar to the districts and the trade in honey and wax.

Panch Mahals.

Commencing with the Panch Maháls we are informed that three kinds of bees are known in this division; the large or *Bhammar* bee (**Apis dorsata**), the common kind (**A. florea**) building under railway bridges, and the smallest or *Kunti* bee, a species of **Trigona**. The honey and wax are collected over most of the division, but the crop is greatest in the two eastern talukas, Dohad and Jhalod. Wild tribes, such as Bhíls and Náikdás, collect the produce of the bees. Men carry long poles with a bundle of dry grass at one end. After climbing a tree they cover themselves with blankets and kindling the grass, sweep the bees off the comb with it; they then cut off the combs from the branches and lower them to the ground. When nests occur in hollow trees the bees are smoked out and the honey and wax removed by hand. The supply is plentiful, and the gathering of wax forms one of the means of support for the jungle tribes in the hot weather. About 100 maunds or 4,000 lbs. of wax are exported every year, and the value is from R25 to R30 per maund of 40 lbs. The bazar rate is about 10 annas per pound.

West Khandesh.

The forests of West Khandesh produce five kinds of bees of which the Bhawar bee (**A. dorsata**), as usual, is the largest honey and wax producer. The other bees occurring in this division are:—

Kotya (**Trigona**); size of black ants raising combs in the hollows of trees.

Mohri (**A. indica**) found in the hollows of trees and rocks.

Zinya or common bee smaller than cattle flies and harmless; combs contain much honey and a whitish wax.

Sondya, white bees, somewhat larger than ants. They raise combs in small branches of trees and in crevices of the earth,

CENTRES OF TRADE.

Bombay.

and store up honey in the hot season, April and May. The honey is white.

The Sátpúrá ranges, *viz.*, Shirpur, Shahade and Akrain, export wax in abundance, which is brought in for sale by the Bhíls and other wild tribes. The export is about 10 maunds annually. The wax sells locally for 8 annas per pound.

East Khandesh.

In East Khandesh honey and wax are collected by Bhíls, Náháls, Tadvís and other hill tribes inhabiting the Sátpúrás. The products are only sufficient for local consumption and there is no export trade. The three bees known in the division are the *Sadhe* (**A. indica**), *Age* (**A. dorsata**) and the *Koti* bee (**Trigona sp.**).

Sholapur.

Honey and wax are not obtained in large quantity in the Sholápur division on account of the scarcity of trees and wild flowers. The combs are collected by low caste Kunbís, Mahars and Mangs, but wax is not exported.

Satara.

In Sátára combs are collected by fishers (Kolís), shepherds (Dhángars) farmers (Kunbís and Kamoses). A fair supply of honey and wax may be obtained in Jáoli, Mahábleshwar, Patara and Spirada ranges, and in the western part of Sátára and Wái. About four kundis (of 560 lbs.) are exported annually. A single comb will sometimes fill 10 or 15 bottles with honey, and supposing one bottle to be worth three annas, the whole costs R2-8 or R3. Wax is valued at one-quarter the price of the honey.

Ratnagiri.

There are three kinds of bees met with at Ratnágiri which produce only sufficient honey and wax for local requirements. The honey combs are formed by the *Kalambe* or *Aghya* (**A. dorsata**) found in inaccessible rocks or on branches of tall trees; the *Katyal* (**A. florea**) found in small trees or bushes; and the *Poyé* (**Trigona**) lodged in hollow tree trunks or burrows of ant-hills. The honey and wax are collected by Kunbís or the labouring class, as at Kolába, but there is no export of wax from the division. The local price is 4 annas a seer of 28 tolahs.

Kánara, for purposes of Forest administration, is divided into a Northern, Southern, and Central Circle, and in each of these divisions there are large supplies of wax collected and sent to Bombay.

Kanara.

The combs are not gathered in Kánara by any particular class of people, and anyone may collect outside of forest limits. The right to collect honey and wax inside forest limits is farmed out to contractors and sold yearly to the highest bidder. In the Northern Division, the *Konge* bee (**A. dorsata**) supplies large quantities of combs. Expert climbers ascend the trees at night, and with smouldering torches drive off the bees and remove the comb in baskets. The following sums were received in 1894 for collecting comb in the jungles:—Supa

CENTRES OF TRADE.

Bombay.

range, R500; Haliyál range, R75; and Kárwár range, R50. The wax averages R14 per maund, and is principally purchased by Goanese for making wax candles.

Kanara.

In the Central Division, Kánara, the supply of wax is derived chiefly from Yellapur and Mundgod, Yellapur producing 2,250 lbs. and Mundgod 750 lbs., or an annual outturn of about 3,000 lbs. Wax is sold by the collector for R275 to R290 per *kandi* of 560 lbs. and is purchased by Goanese. Inferior portions left by straining are sold at a low price. A peculiar fact has been noticed in this division, that the honey is always at its best when the *Karvi* (**Strobilanthes ciliatus,** *Nees*) is in flower. This interesting fact confirms the belief in the virtue of this tribe of plants in affording a superior food for Indian bees.

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The four talukas of Sirsi, Siddapur, Kumta and Honawar in the Southern Division, Kánara, are largely used by honey and wax contractors. The values of the contracts for three years ending 1893-94 were—

	1891-92. R	1892-93. R	1893-94. R
Sirsi	1,571	865	1,340
Siddapur. . . .	157	122	139
Honawar . . .	48	73	64

The contractor, while keeping a little for local sales, sends most of the wax to Bombay in square wooden boxes. The price is very low, being only 3 or 4 annas a seer of two pounds. There is such a ready sale for the wax that very little trouble is taken to preserve the honey.

Belgaum.

The seasons for collecting wax in Belgaum are May and November. There are four kinds of bees met with in the district, **A. dorsata, A. indica, A. florea** and a **Trigona**; but the bulk of the wax comes from the combs of the **A. dorsata**, which is known by the Marathi name *Konegi.* The combs are collected by the village people, principally Mhars, Kunbís and shepherds, those of the *Konegi* bee are only collected at night, at which time the bees are less inclined to use their stings. The supply of wax in this district is not large, amounting in all to about 50 or 60 maunds (28 lbs. each). Most of the wax is exported to Goa and Bombay; the market price in Belgaum ruling at from R15 to R20 per maund.

Dharwar.

In Dhárwár combs are collected by Lamanis and Hale Paiks, and the wax is made up into balls. The amount collected annually is 60 maunds valued at R10 per maund. It is estimated that R300 worth of wax is annually exported from the division.

Experiments in apiculture have been attempted in the hill-stations of Bombay, but as far as can be ascertained, with no very signal success. The only bee which can be said to be domesticated is the *Nasri-jen* of Kánara (a species of **Trigona**), the honey of which has a peculiar taste and is prized for its medicinal properties.

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Berar.

BERAR.—Reports on the collection of honey and wax in the Hyderabad Assigned Districts have been received from Wún, Básim and Ellichpur through Mr. Cecil Bagshaw, the Conservator of Forests. The abundance of supply depends to a great extent on climatic conditions; a dry season being responsible for a large yield, while a heavy rainfall prevents the formation of combs. The industry is in the hands of the Kúrkús or country people, and the Gonds, Kolams, Banjárás and other wild tribes. The collection of the *Agya* combs **(A. dorsata)** is very troublesome and is only performed at night time. A man clad in a blanket climbs up one of the trees (which are very lofty, such as the *Bar*, *Pipul* or *Anjan*) and, with a torch in his hand, burns and disperses the bees. The collectors usually rub themselves over with some kind of ointment prepared from herbs, the composition of which is known only to the Gonds and Kolams, and is said to be sting-proof.

Trade.

The extent of the export of wax cannot be even approximately given as some is collected in forests belonging to Izardars; moreover, no records are kept, as from certain forest lands, head loads are allowed to be removed free of duty. Pusád Taluk in Básim gives a fair yield, and as much as R1,000 to R1,500 worth is reported to be sold annually in the bazars. Collections are also made in the forests of the Melghát, Ellichpur, and in Mangrúl and Wún, but the exports, if any, are of no commercial importance. The bazar price of wax in Ellichpur is 4 annas per pound which is very low.

The bees from the Wún district have been identified as **Apis dorsata** and **A. florea**; those from the Básim district as **A. dorsata, A. florea** and **Trigona sp.**; and those from Ellichpur as **A. dorsata** (*Agia* bees) and **A. indica** (*Koti* bees).

Madras.

MADRAS.—This Presidency supplies large quantities of wax and honey for local and export purposes at very moderate rates, and in many districts the trade is capable of great expansion. The hilly regions from Ganjam to Tinnevelly on the Eastern Coast, and the Western Gháts of South Kánara and Malabar are the abodes of wild bees of the **Apis** family whose combs are annually gathered by the hill tribes.

In Ganjam and Vizagapatam the Konds recognise four different kinds of bees known by the Uriya names of—

(*a*) *Bhaga mohu*, a large sized bee (**Apis dorsata**).
(*b*) *Sattapuri mohu*, building its comb in 7 layers (**A. indica**).
(*c*) *Binchina mohu*, with a comb like a fan.
(*d*) *Nikiti mohu*, a very small bee.

The honey and wax are collected by the Konds and a class of men called Benias, who almost live in the forest and are expert

CENTRES OF TRADE.

Madras.

climbers of precipitous rocks and lofty trees. From Gúmsúr from 600 to 700 lbs. of wax are annually exported, and a large quantity in addition is brought down from the hills. The local price is 6 to 7 annas per pound. The estimated annual outturn of wax in Kondasemtha and Kristurdesrepeta is about 800 maunds, which sells at the average rate of R17 per maund.

In the Pálakonda range of Vizagapatam professional honey gatherers belong to the Savaras, Jotoahas and a tribe called Nakkalus.

Godavari.

The Godávari and Kistná districts afford honey and wax more than sufficient in amount for local requirements. It is collected by Gottehs and Kays. Wax is one of the principal products of Peddapuram in Godávari, and in the Kistná district it is procured from Satterapalle, Palnád, Vinukonda and Bundar. A collector in the last named district is let down the rocks with a basket lined with wax, a knife, brushwood and a light. When he reaches a comb he cuts away the underpart containing the larvæ, which can usually be done at night without disturbing the bees; he then lights the brushwood to drive the bees out and cuts off the upper portion of the comb and puts it in the wax-lined basket. At Vinukonda wax sells for R12 the maund of 25 lbs., but there is no great supply as the quantities collected are mostly consumed locally.

Kurnool.

Kurnool.—Large collections of honey and wax are made on the Nellamalái Hills in Kurnool. The hillmen of the Chenchu tribe are the collectors of these products, and this has been their recognised caste occupation from time immemorial. It is strange that this class of people, otherwise most cowardly and apathetic, have the courage to venture into these apparently inaccessible and dangerous places. The estimated quantity of wax exported from Sirvel taluk is about 200 maunds, this is brought to the market from Muttanal and Chruvu. In 1894 Sirvel exported 5,000 lbs. of wax valued at 4 annas per pound, and Nandyál 250 lbs. at 8 annas. The whole is sold to Bombay and Madras merchants. Very little honey or wax is collected in the Verramalai Hills.

Bellary.

Bellary affords wax in the Ráyadrug and Sandúr zamindaries. The combs are collected by Boyas and Bedars from Government leased forests, the Raja's forest at Sandúr, and from reserve forests near Ráyadrug. The combs occur in crevices of over-hanging rocks. It has been observed in this district that when the Tamarind tree flowers profusely a large yield of honey is always obtained. About 20 maunds of wax are exported each year from the Ráyadrug reserve, selling at the low price of R3-12 per maund.

Cuddapah.—Wax is collected by the hill tribes, Chenchus and Yánadís, from the combs of the **Apis dorsata** found in crevices

CENTRES OF TRADE.

Madras.

of cliffs and on the trunks of trees. Men are lowered from the rocks with lighted torches and collect the combs in baskets. 150 maunds of wax are annually exported from this district, and is chiefly sent to the Madras markets where it sells for R15 to R20 per maund.

Nellore.

The Yánadís and Muthuragus are the expert comb collectors of the Nellore district, and the localities are the Veligondahs (a part of the Eastern Ghâts) and to some extent the island of Sriharíkota. When the hives are built on precipitous rocks, a drop made partly of bamboo and partly of *Jurvi* (**Ficus Tsiela**) fibre is let down the cliffs after securing one end of it to a tree or staple. One of the party then descends by the drop, and for his safety a rope is passed under his arms. He carries with him a leather bag, a torch made up of whisks of grass, and a stout stick. On getting in line with the combs he lashes himself to the drop, lights the torch to drive away the bees, and removes the combs, which are handed up to those of the party waiting above the cliffs. Statistics as to the quantity collected are not available, but about 20 maunds or 500 lbs. of wax are annually exported. The price is R3-5-4 per maund which the middlemen sell at the rate of R12 to R16. The bees from this district were thus identified :—

Perai Tenai Egalu .	**Apis dorsata.**
Thorri Tenai Egalu .	**A. indica.**
Pulla Tenai Egalu .	**A. florea.**
Mussan Tenai Egalu .	**Trigona sp.**

North Arcot.

In North Arcot combs are collected by Irulas or Yánadís all over the hill forests. The combs are reached by means of a ladder made of the *Zidda thiga* creeper suspended from the rock; combs are collected chiefly for their wax which is largely exported to Madras, Vellore and Vaniyambádi. The combs are said to yield ½ viss of wax and 1 viss of honey. The wax is sold for 12 annas a viss locally, and in Madras at R2-8 a viss. (1 Viss = 3·65 lbs. Av.)

Trichinopoly.

Honey and wax are collected in the mountainous and thick jungles of Trichinopoly such as those of Pachamálais, the Marnagapuri, the Kolavur hills, and the Musiri range, where wax is obtained in some abundance. Wax is also one of the principal products of the Pachamálai hills. The combs are collected from large trees and from species of **Euphorbia.** The Catholic missionaries of Trichinopoly have tried to domesticate certain kinds of indigenous bees, but, as far as can be ascertained, with only indifferent results.

There is a limited industry in honey and wax in Tinnevelly, where hill-men and coolies collect combs near the foot of the hills. There is no means of knowing the extent of supply as the right to collect is leased out to contractors who extract other minor produce

CENTRES OF TRADE.

Madras.

from the forests. The price of the wax varies from R14 to R16 per maund. Madura affords limited supplies of honey and wax from the Saduragi and Varshanad hills.

Coimbatore.

Coimbatore is a large centre of the wax trade in South India as the hills on the north, south, and west are the homes of innumerable bees. In South Coimbatore combs are collected by Irulars, Maduvars, and Kaders in the forests of Tunacadavu, Pollachi, Udamalpet, Metupolyam and Bolampati ranges. The collection of the honey combs is a dangerous occupation. A hill man with a torch in his hand and a number of bamboo tubes suspended from his shoulders descends by means of ropes or creepers to the vicinity of the comb. The sight of the torch drives away the bees, and he proceeds to fill the bamboos with the comb, and then ascends to the top of the rock. 200 maunds of wax are collected annually and sells for R7 per maund.

The hill men on the eastern side of Mangapatti domesticate bees to a small extent. The contrivances to hive them are small mud houses a foot square, or earthen chatties or pots placed mouth downwards with a few holes made in the bottom.

In North Coimbatore Sholagars, a wild tribe, collect combs from rocky crevices. These combs are much larger than those found on trees and are supposed to contain twice as much wax in proportion to the honey. Kollegal and Bhavání ranges furnish about 125 maunds of wax a year which is all exported.

Nilgiris.

On the Nilgiri Hills the aboriginal tribes of Todas, Badagas and Karumbas are adepts at collecting and preparing honey and wax for the market. On these hills the combs of **Apis dorsata** are found at an elevation of 5,000 feet, and these combs are collected by Jain Karumbers and Sholagars. The supply of honey varies according to the nature of the season, and is especially plentiful and of good quality when **Strobilanthes Wightianus, S. Kunthianus** and other species are in flower. These plants clothe the hillsides with blossom in certain places once every few years.

Malabar.

In North Malabar combs are collected by Jain (honey) Karumbers in the Kudracote and Begur reserves. The **Apis dorsata**, building on trees, supplies large quantities of wax and honey. About 170 lbs. of wax are collected annually from the above reserves; it is sold at Manantoddy and taken to Tellicherri and Mysore.

The three bees found in South Malabar are—**A. dorsata, A. indica** and **A. florea**. The combs are collected by a wild tribe called Naikers. Sometimes the combs of the first named bee are so large that one cannot be carried by a single person. They are removed from the rocks by night when there is no moon. A man is let down the rock by a rope or rattan, and with a torch in his hand, he drives away the bees. He then removes the combs which are

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Madras.

placed in baskets and carried up by another rope. About 25 maunds of wax can be exported from the district annually.

South Kanara.

South Kánara.—The hill tribes gather honey and wax from the rocky spurs of the Western Gháts. Coondapoor taluk furnishes 40 maunds a year, Udipi 50 maunds, Mangalore 5, Uppinangadi 7, and Kásaragod 20.

The quantity of wax exported ten years ago was—

	1891-92.	1892-93.	1893-94.
Cwts.	200	84	75
Rupees	15,922	6,802	6,116

Rupees 5 to R20 a maund are the prices between which it fluctuates in the district.

The following were the prices for bees'-wax in the Madras Presidency in 1894:—

	Per pound. a.	p.
Nallamaláis, Kurnool	1	4
North Arcot	1	8
Nellore	2	2
Waltair, Northern Circle	2	4
South Coimbatore	4	6
South Kánara	3 to 12	2 8
Ganjam	6 to 7	0 0
North Malabar	8	0
Tinnevelly	9 to 10	0 0
Vizagapatam (average)	11	0
South Malabar	12	0
Cuddapah (at Madras)	9 to 12	6 8

Middle men or Chetties purchase wax from the jungle tribes of Arcot, Kurnool and Nellore and resell at twice and three times the price at large towns. The Madras maund is the usual weight by which wax is sold, this is equivalent to the weight of 1,000 tolas or rupees, or 25 pounds. The prices at South Kánara annas 3-2 to 12-8 is equal to R5 to R20 per maund.

Burma.

BURMA.—Honey and bees'-wax are collected in Upper and Lower Chindwin, Kátha, Mandalay, Pyinmána, Minbu and Tenasserim. The season for taking the combs and selling the products is from March to May. The Chins at this time of the year are particularly energetic in collecting over the large tract of country at the foot of their hills. The Chins have an interesting custom with regard to the

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Burma.

gathering of the combs. In some villages each man has a recognised claim to collect over a certain locality; this claim he has inherited from his ancestors, and on his death, the privilege descends to one of his children.

Species of Bee.

The bees of Burma are of four kinds. The *Pya gyi* (**Apis dorsata**) is the largest, about an inch long, blue black on the dorsal surface with yellowish sides. The combs are found on huge forest trees and occasionally in crevices of rocks. The combs sometimes weigh from 25 to 30 viss, or on an average 15 to 20 viss; one of these will yield from 5 to 10 lbs. of honey and 1 to 1½ lbs. of wax.

The *Pya-aung* is a medium-sized bee building chiefly in the hollows of trees.

The *Yin pya* or **Apis florea** is the smallest kind, and builds small combs in bamboos and bushes which yield only ¼ to ½ lb. of wax each.

Collection.

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The *Pya gyi* is the most important, as the honey of the other bees is often tainted and the wax very dark in colour. In the season a party of wax-gatherers consisting of three men, one being an expert climber, proceed to the forests. The bees are stupified or driven off by means of smoking torches, and the hives are then cut off and lowered by ropes to the men below. The smoke of a Burmese cheroot is sufficient to drive off the bees from a small comb. The Karens ascend trees for the purpose of obtaining honey by means of bamboo spikes driven into the wood. When combs are found on the sides of steep cliffs and limestone rocks in the hills, the collector, suspended by a rope-swing, knocks off the whole of the combs with a pole and they fall to the bottom of the hill. Bees are much more plentiful when the **Strobilanthes** (*panthinbin*) is in flower, an event which happens about every six years.

A curious ceremony is performed in the Kabaw valley, Upper Chindwin District, by certain associated villagers when the flowering takes place. The villagers build bamboo hives near their villages, and after having made offerings to their *Nats* (wood demons, Dryads) they, after having themselves gone through a complicated ritual accompanied with songs sung in the Kudu dialect of the Shán language, invite the bees to swarm, the Sháns at the same time make as much noise as possible by striking tortoise-shells with a stick made from a fresh-water cat-fish (dried in the sun till it is like a bone, *Nga-yan*). They then leave the hives, visiting them every now and then to see if bees have swarmed, and going through the rite again on any sign of a swarm. If swarming follows, they eat the resulting honey. This festival coincides with the flowering cycle of the *Moyan*, a species of **Strobilanthes**, shrubs of which genus are known to blossom at regular intervals in hilly regions of Southern India as well as Burma.

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CENTRES OF TRADE.

Burma.

A considerable and expanding trade in bees'-wax is carried on in the Upper Chindwin Division; the duty returns for the two years, 1892-93 and 1893-94, being 1,636¼ viss and 3,541 viss, respectively. These amounts of revenue were paid at Kindat. The honey is of poor quality, and is only used by the Burmans, but the wax collected by the Chins is brought for sale to the Kabaw Valley and to several riverside villages on the upper reaches of the Chindwin up to Kanti.

The trade is in the hands of Burmans and Chinese who pay R1 to R1-8 to the Chins for the wax. The value at Kindat being R2 per viss and the Government duty 12½ per cent. *ad valorem,* so it will be seen that there is a wide margin for profit in wax transactions.

Lower Chindwin.

In Lower Chindwin Maukadaw is the centre of the honey and wax industry. The supply is abundant, and if communications were better in the Mahamyaing Forest, there is no doubt that trade could be greatly developed. The three bees peculiar to this Division are the *Pya-gyi* (**A. dorsata**), the *Yin-pya,* which makes a comb with a smaller proportion of wax, and the small dammar-bee producing the black substance called Pwe-nyet.

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Some of the largest combs of the **Apis dorsata** yield about 50 viss of wax. The annual outturn of wax is said to be between 2,000 and 3,000 viss.

Eastern Circle.

In the Eastern Circle, Upper Burma, wax is a minor forest product obtained from Bhamo, Kátha, Mandalay and Pyinmána. In 1893-94 the total amount obtained by license was 573 viss valued at R126, an improvement on the previous year which was given as 250 viss valued at R50. These figures do not give the whole of the amount extracted from the forests, as some of the licenses are purchased in kind. For instance in Kátha there were 10 licenses issued in 1892, 28 in 1893, and 22 in 1894, and reckoning 30 viss of wax for each license, a very fair estimate may be obtained of the amount extracted by each license holder.

Western Circle.

In the Western Circle honey and wax are gathered in Upper Chindwin and Minbu; in the former division, in 1893-94, 187 licenses brought in 4,437 viss valued at R935, and in the latter division 5 licenses gave 500 viss valued at R10. The total yield of the Circle for the year returned a considerable increase over that of 1892-93, which was returned at 2,036 viss valued at R460.

The right to collect bees'-wax and honey in the forests in Tenasserim is sold by public auction yearly. The following table gives the amount realized during the five years :—

1888-89.	1889-90.	1890-91.	1891-92.	1892-93.
R	R	R	R	R
1,286	895	545	1,105	1,085

CENTRES OF TRADE.

Burma.

The price of bees'-wax in Lower Chindwin, Pyinmána and Kátha is R2-8 per viss of 3·65 lbs., or 10·9 annas per lb. This is the rate in the jungle, in the towns it is 50 per cent. higher.

Tenasserim.

In Tenasserim the price fluctuates from R2 to R5 per viss (8¾ annas to R1-5-11 per lb.) as shown by the market rates in the following townships: Yé R5, Wagaru R2, Zaya R4, Ataran R2-8 to R3, East Salween R2. The markets are not supplied from local collections, but the wax is imported from Moulmein. In 1893-94, 22 cwt. of wax valued at R1,976 was exported from Mergui on the Tenasserim coast.

There are no records of any successful domestication of bees in Burma. The Kachins are said to have domesticated some forms of the wild bee, and in some of the hills experiments were made with the stingless bee (A. florea?), but it was found to give so little honey that the trials were abandoned.

EXPORTS FROM INDIA.

The following is the quantity of bees'-wax exported from the whole of India to foreign countries during the past twenty-four years :—

	Cwt.	R
1878-79	3,311	2,66,644
1880-81	6,592	5,45,110
1885-86	5,635	4,11,127
1887-88	5,989	4,61,605
1888-89	4,573	3,45,911
1889-90	4,222	3,05,499
1890-91	6,514	4,73,630
1891-92	5,814	4,47,375
1892-93	4,667	3,68,261
1893-94	5,816	4,90,874
1894-95	7,487	7,05,247
1895-96	5,882	5,64,715
1896-97	3,142	2,76,190
1897-98	3,537	2,80,806
1898-99	4,846	3,89,379
1899-1900	5,787	4,64,172
1900-01	5,059	4,26,917
1901-02	4,139	3,64,179
1902-03	4,481	3,84,753

Exports from	
Bengal	3,020
Bombay	762
Madras	427
Burma	230
Sind	42
	4,481

To	Cwts.
Straits	2,062
United Kingdom	1,313
Germany	534
Ceylon	312
France	176
United States	67
Java, Belgium, Mauritius, etc.	17
	4,481

USES OF WAX.

THE USES OF WAX.

Bees'-wax is known in India under the following vernacular names :—

> ***Móm***, HIND., BENG.; DEC, PERS.; ***Sinth***, KASH.; ***Mena***, MAR., KAN.; ***Min***. GUZ.; ***Mozhukkin***, ***méllugú***, TAM.; ***Mainam***, ***minum***, TEL.; ***Mezhuka***, ***lelin***, MALAY.; ***Phayonie***, BURM.; ***Madhujam***, ***siktha***, SANS.; ***Shama***, ARAB.; ***Itti***, CINGH.

Compared with the amount exported wax has only a limited use in the country, but for many years it has regularly been employed in minor industries. Tavernier in his "Travels," Vol. II., p. 413, says: "Wax is cheap throughout India and is easily bleached, every religious house always has a large supply of wax tapers on account of the festivals when numbers are lighted before the grand altar and in all the chapels. Even the least of the Dutch sailors had 30 or 40 of the tapers for his share, and some of them had some as thick as the thigh."

A considerable amount of wax from the Western Coast is sent to Goa annually to be made into candles for burning in the churches during religious services, and in Burma thousands of wax candles illuminate the pagodas during Buddhist ceremonies.

In the Central Provinces it is used by Chipas for stamping patterns on cloth. And in Burma it makes wax-resist patterns for dyeing silk. In North Arcot it enters into the preparation of wax cloth.

The Kasarars and Lonars (metal-workers) use wax for making impressions and moulds of images and for other purposes.

Wax is one of the ingredients for preparing artificial flowers.

In medicine white and yellow wax enter largely into the manufacture of ointments and plasters. Under the name of Cera flava (yellow wax) and Cera alba (white wax) it is official in all the Pharmacopœias.

CHEMICAL EXAMINATION.

CHEMICAL EXAMINATION OF THE WAX.

Bees'-wax is chiefly a mixture of cerotic acid and myricin or myricyl palmitate. In smaller quantities there occur also melissic acid in the free state, and myricyl alcohol and ceryl alcohol. Small quantities of unsaturated fatty acid and hydrocarbons have also been found. Schwalb has isolated two hydrocarbons, heptocosane melting at 60·5 and hentriacontane melting at 67°C.

The ratio of free acid, regarded as cerotic acid, and myricin, has been found by Hubl and Hehner in a number of well-agreeing experiments as 14 : 86.

Bees'-wax is almost insoluble in cold alcohol, but boiling alcohol dissolves from it the bulk of cerotic acid and a small quantity of

CHEMICAL EXAMINATION.

myricin. An alcoholic solution is acid in reaction. On cooling a hot alcoholic solution of wax cerotic acid separates out in the form of thin needles so completely that the solution does not become turbid on mixing with water, a slight opalescence only appearing.

Warm ether dissolves bees'-wax with facility; chloroform dissolves it in the cold, leaving behind any impurities.

Bees'-wax is frequently adulterated in the European markets. The usual adulterants are water, mineral matters (yellow ochre, gypsum, etc.), flour and starch, tallow, stearic acid, Japan wax, carnauba wax, resin, paraffin wax or cerasin. The mineral and vegetable structures may be detected with the microscope or some simple methods, but the identification of foreign fats and waxes requires a more intimate acquaintance with the chemical character and constituents of the wax.

The constants of European bees'-wax as given by **Lewkowitsch** in "Chemical Analysis of Oils, Fats and Waxes" are arranged below :—

		Mean.
Melting point	61·5°— 65°	63·2°
Acid value	16·8 — 21·2	19
Ether value	71·8 — 76·1	73·9
Saponification value . .	87·8 —107·0	97·4
Iodine value . . .	7·9 — 11	9·4

These numbers apply to the wax secreted by bees of different species, such, for instance, as that of **Apis mellifica**, *Linn.*, and **A. ligustica**, *Spinola*, showing the practical identity of samples from different zoological sources. In testing samples from different countries, provided they are genuine and unadulterated, the results accord substantially with the above figures.

Adulterants.

In order to compare the numbers or constants with those of other materials used for adulterating bees'-wax the following table is appended :—

	Melting point.	Acid value.	Ether value.	Saponification value.
Japan wax	54°	20	200	220
Carnauba wax	84°	4	75	79
Chinese wax	81°	trace	63	63
Tallow	45°	4	176	180
Stearic acid	71°	195	...	195
Rosin	100°	140	20	160
Paraffin or Cerasin . . .	44—61°	...	...	...
Pure wax	63°	20	75	95

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According to this table the lowering of the acid and saponification values of a sample would indicate the presence of paraffin wax, and a higher value than the normal would show possible adulteration with stearic acid, tallow or Japan wax. Mixtures, however, may be made of these materials which resemble bees'-wax in so many particulars that it would be difficult to detect the sophistication by ordinary methods of analysis.

Regarding the bees'-wax of Indian origin it does not appear that authentic samples have been subjected to any systematic examination, although it readily finds markets in different parts of the world and realises fair prices when carefully refined. In a paper by G. Buchner on "The Analysis of Bees'-wax" abstracted in the *Journ. Soc. Chem. Industry*, 1901, a short notice is given of a particular kind of Indian wax. Under the name of "Ghedda wax" the author states :—

Ghedda Wax.

> "This is a very plastic, aromatic wax derived from British India. It gives very abnormal figures, and the author has frequently met with a sample giving results such as—Acid value 5·33, Ether value 88·35, and Saponification value 93·68."

With the object of making a fuller enquiry into the subject and to test the relative values of a series of waxes from different parts of India the samples in the Indian Museum were examined. These specimens had been sent in answer to the circular letter sent by the Reporter on Economic Products, and a large number of the waxes had been prepared from the combs of bees which were entomologically identified. In the accompanying list is set forth the registration number, locality of collection, appearance of the sample and, when possible, the origin of the wax.

List of samples.

Reg. No.	District.	Origin of wax.	Colour of wax.
280	Panjáb	......	Dirty white.
284	Madras	......	Clean white.
285	„	......	Whitish.
286	Poona, Bombay	......	Dirty white.
287	Birbhum, Bengal	......	White.
308	Simla, Panjab	......	Light yellow.
309	Jessore, Bengal	......	Brownish, dirty.
310	Burma	......	Dirty white.
318	Poona, Bombay	......	Ditto.
327	Madras	......	Light brown.
328	„	......	Light brown, dirty.
339	Birbhum, Bengal	......	Dirty white.
1459	Andaman Islands	......	Black.
4608	Ráipur, Central Provinces	Apis dorsata	Dull white.
4610	„ „ „	„ florea	Brownish, dirty.

CHEMICAL EXAMINATION.

List of samples.

Reg. No.	District.	Origin of wax.	Colour of wax.
4614	Ráipur, Central Provinces	Trigona sp.	Black.
4616	Nagpur, „ „	Apis florea	Ditto.
4624	Nimár, „ „	„ „	Ditto.
4630	Cuddapah, Madras	„ dorsata	Yellowish white.
4743	Godhra, Bombay	......	Light brown.
4744	Panch Maháls, Bombay	Apis florea	Dirty white.
4745	Jhalad Taluq, Bombay	„ „	Whitish.
4755	Sundarbans, Bengal	Apis dorsata	Dirty white.
4756	„ „	„ „	Whitish.
4760	Damoh, Central Provinces	„ indica	Dull white.
4761	„ „ „	*Kote* (Trigona)	Black.
4762	Jabalpur, Central Provinces	......	Whitish.
4765	Nilgiris, Madras	Apis indica	Light brown.
4785	S. Coimbatore, Madras	„ dorsata (pure)	White clean.
4803	Chaibassa, Bengal	„ dorsata	Very impure.
4832	Dhárwár, Bombay	„ florea	Dull, whitish.
4874	Sirsi, Kánara, Bombay	Trigona sp.	Brownish black.
4912	Dehra Dun, United Provinces	Apis dorsata	Dull white.
4916	„ „ „	„ „	Dirty white.
4963	South Malabar, Madras	„ „	Light yellow brown.
4968	North „ „	„ „	Light brown.
5031 and 5035	Nellore, „ „	„ indica	Dull white.
5047	Sambalpur, Central Provinces	„ dorsata	Whitish.
5049	„ „ „	Trigona sp.	Black.
5051	Chhindwárá, Central Provinces	Apis dorsata	Light brown.
5053	„ „ „	„ florea	Black.
5137	Trichinopoly, Madras	......	Dull white.
5199	Bashahr, Panjáb	......	Light brown.
5613	South Kánara, Madras	Apis florea	Brown.
5616	Coondapore, „	Trigona sp.	Black.
5617	South Kánara, „	Thodijiga bees	Light brown.
5720	East Khándesh, Bombay	Apis dorsata	Brownish.
5726	„ „ „	Trigona sp.	Light yellowish brown.
5746	Hazára, Panjáb	Apis dorsata	Brown.
5766	Coimbatore, Madras	„ „	White clean.
5768	„ „	Koorbuthan bees	Yellow brown.
5774	„ „	Apis indica	Very light brown.
5777	„ „	„ dorsata	Dull white.
5780	Madras	„ „	Yellowish white.
6009	Mussoorie, United Provinces	„ sp. (Autumn)	Dull white.

CHEMICAL EXAMINATION.

List of samples.

Reg. No.	District.	Origin of wax.	Colour of wax.
6138	Gurdáspur, Panjáb	Apis dorsata	Light brown dirty.
6141	,, ,,	,, indica	Brownish.
6241	Dehra Dun, United Provinces	,, dorsata	Soapy colour.
6244	,, ,, ,,	,, indica	Yellowish.
6308	Sooligarh, Central Provinces	,, dorsata	Dirty white.
6529	Rawalpindi, Panjab	,, indica	White.
6653	Almora	,, dorsata	Dirty white.
17949	Sundarbans, Bengal	Refined	Ditto.
21061	Sahåranpur, United Provinces	Apis dorsata	Yellowish.
21062	,, ,, ,,	Refined	White.

Constants determined.

In the following tables the results of the examinations are classified according to the origin of the specimens. Figures are given for the melting point, acid value, saponification value, ether value and iodine value.

Melting point.—This was taken by means of a glass capillary tube suspended in water by the side of a Centigrade thermometer. The temperature was read off immediately the melting wax rose in the tube.

Acid value.—This was determined by heating the wax in boiling alcohol and noting the amount of alcoholic potash required to neutralise the free acids, using phenol-phthalein as an indicator.

Saponification value.—The amount of caustic potash (K H O) required to saponify a weighed quantity of the wax, after boiling for three hours in an inverted condensor.

Ether value.—This figure is arrived at by subtracting the acid value from the saponification value.

Iodine value.—Hubl's method of estimation by means of an alcoholic solution of iodine and mercuric chloride was employed. The iodine solution was allowed to act for 12 hours.

The Specific Gravity was only determined in a few selected samples. While English bees'-wax had a density of 0·960, three samples of Indian wax varied between 0·953 and 0·964. The **Trigona** wax like that of the adulterated samples had a higher gravity, *viz.*, 0·980 to 1·000, and therefore scarcely floated in water.

When much dirt was present the sample was dissolved in chloroform to remove impurities, and the analysis was conducted on the clarified portion.

CHEMICAL EXAMINATION.

ANALYSES.

Analyses of Bees'-wax.

Reg. No.	Melting point.	Acid value.	Ether value.	Saponification value.	Iodine value.	REMARKS.
	BEES'-WAX SAMPLES (ORIGIN NOT STATED).					
280 .	66°	7·4	87·8	95·2	8·2	
284 .	61·5°	10·2	87·8	98·0	6·5	
285 .	62·2°	8·8	87·2	96·0	5·1	
286 .	66°	10·8	87·8	98·6	4·9	
287 .	62·2°	11·5	83·0	94·5	4·5	
309 .	68°	11·1	80·4	91·5	7·2	
310 .	68°	13·2	74·8	88·0	2·3	
318 .	63·5°	8·3	84·7	93·0	4·0	
327 .	62°	7·2	84·3	91·5	6·6	
328 .	62·5°	7·2	80·8	88·0	4·5	
339 .	62°	8·3	93·7	102·0	5·1	
4743	63°	8·1	89·4	97·5	7·1	
4745 .	63°	7·3	85·2	92·5	5·9	
4762 .	61·5°	7·4	97·6	105·0	5·7	
5137 .	61·5°	7·3	92·7	100·0	5·7	
5199 .	66·5°	5·2	80·2	85·4	10·7	
5617 .	65°	9·5	136·1	145·6	5·9	
5726 .	62°	10·4	87·5	97·9	8·8	
5768 .	64°	5·8	92·8	98·0	8·5	
6009 .	69°	6·1	83·9	90·0	9·7	
Average .	63·9°	8·5	88·9	97·4	6·3	
Maximum	69°	13·2	136·1	145·6	10·7	
Minimum	61·5°	5·2	74·8	85·4	2·3	
	Apis florea.					
4610 .	63·2°	6·1	85·9	92·0	9·0	
4744 .	64°	7·7	80·8	88·5	11·4	
4832 .	68°	6·7	123·8	130·5	7·7	7·9 per cent. insoluble.
5053 .	63°	8·4	84·0	92·4	6·0	3·6 per cent. insoluble.
5613 .	63°	8·9	103·7	112·6	6·0	Impure.
Average .	64·2°	7·5	95·6	103·2	8·0	
Maximum	68°	8·9	123·8	130·5	11·4	
Minimum	63°	6·1	80·8	88·5	6·6	

Apis florea.

CHEMICAL EXAMINATION.

ANALYSES.

Analysis of samples of Bees'-wax.

Reg. No.	Melting point.	Acid value.	Ether value.	Saponification value.	Iodine value.	REMARKS.
			Apis dorsata.			
4608 .	62°	7·2	97·8	105·0	5·2	
4630 .	62°	9·1	80·9	90·0	6·2	
4755 .	63°	10·2	87·3	97·5	4·8	
4756 .	64°	7·3	87·7	95·0	5·0	
4785 .	62·5°	4·4	90·7	95·1	5·2	
4803 .	61°					Very impure.
4912 .	67°	7·7	84·3	92·0	7·8	
4916 .	63°	6·6	91·0	97·7	8·3	
4963 .	63°	6·6	93·4	100·0	6·9	
4968 .	62·5°	7·4	97·5	104·0	6·7	
5047 .	62°	7·2	90·4	97·6	6·1	
5051 .	60°	5·9	91·7	97·6	6·9	
5720 .	66·5°	6·1	69·5	75·6	9·0	4·5 per cent. insoluble
5746 .	66·5°	8·2	91·8	100·0	9·9	
5766 .	64°	5·2	95·6	100·8	5·7	10·5 per cent. insoluble.
5777 .	61·5°	5·9	89·3	95·2	5·9	
5780 .	62·5°	7·3	90·7	98·0	5·3	
6138 .	62°	7·4	92·8	100·2	7·6	7·5 per cent. insoluble.
6241 .	64°	8·3	81·7	90·0	9·0	
6308 .	64°	6·6	94·2	100·8	5·9	
6653 .	62°	6·1	85·1	91·2	7·3	
21061 .	63°	5·8	86·6	92·4	8·0	
17946 .	61°	8·1	92·7	100·8	5·2	
Average .	63·1°	7·0	89·4	96·2	6·7	
Maximum	67°	10·2	97·8	105·0	9·9	
Minimum	60°	4·4	69·5	75·6	4·8	
			Apis indica.			
4760 .	62°	6·6	95·9	102·5	6·9	
4765 .	64°	5·8	94·2	100·0	5·3	
5031 5035 } .	63°	7·3	85·4	92·7	9·2	
5774 .	63°	7·3	93·0	100·3	5·7	
6141 .	63·5°	5·0	85·0	90·0	8·5	
6244 .	64°	8·8	84·0	92·8	8·9	
Average .	63·25°	6·8	89·6	96·2	7·4	
Maximum .	64°	8·8	95·9	102·5	9·2	
Minimum .	62°	5·0	84·0	90·0	5·3	

Apis dorsata.

Apis indica.

CHEMICAL EXAMINATION.

ANALYSES.

Analyses of Bees'-wax.

Trigona sp.

Reg. No.	Melting point.	Acid value.	Ether value.	Saponification value.	Iodine value.	Remarks.
		Trigona sp.				
1459	72°	18·5	55·2	73·7	47·6	
4614	68°	20·9	94·9	115·8	48·3	3·1 per cent. insoluble.
4616	76°	21·7	128·3	150·0	30·2	
4624	70°	22·9	56·9	79·8	42·9	6·3 per cent. insoluble.
4761	69°	20·8	74·4	95·2	48·0	
4874	72°	22·8	100·2	123·0	49·6	22·6 per cent. insoluble.
5049	66°	22·7	123·0	145·7	48·2	4·5 per cent. insoluble.
5616	71·5°	16·1	84·0	100·1	39·1	
Average	70·5°	20·8	89·6	110·4	42·2	
Maximum	76°	22·9	128·3	150·0	49·6	
Minimum	66°	16·1	55·2	73·7	30·2	
		Adulterated Wax.				
308	44°	42·3	143·5	185·8	5·7	
6529	43°	36·6	162·9	199·5	3·8	
21062	44°	27·7	165·6	193·3	7·1	
		English Bees'-wax.				
	65°	20·15	77·05	97·20	9·99	

Adulterated Wax.

English Wax.

In studying these tables of analyses two very interesting facts will be revealed. The first is the lower acid value of Indian bees'-wax; this indicates a different ratio between the cerotic acid and myricitin compared with that of waxes from other parts of the world, and the second is the uniformity in composition of the secretion of the three kinds of Indian bees representing the **Apis** family. The appearance of the wax from the three species gives no clue to the origin, and although there are two or three somewhat abnormal deviations from the average on account of the high saponification value and the wide range of the iodine value, there is very little, if any, suspicion of adulteration. The wax from the combs of **Apis dorsata, A. indica** and **A. florea** is, therefore, CHEMICAL EXAMINATION.

practically identical in composition, and a combination of the wax of one species with that of another cannot be regarded as a fraudulent admixture. It must be admitted, however, that the **Apis dorsata**, because of the much larger comb it manufactures, is the chief source of the bees'-wax of the country.

Trigona Wax.

The wax of the **Trigonæ** has quite a different character and composition compared with that of the true bees. The blackish colour, sticky consistence, and higher melting point, acid and iodine values readily distinguish it. These features at once separate it from ordinary bees'-wax, although, according to some of the forest collectors, the origin of wax of this nature was attributed to **A. florea.** From descriptions of the Propolis or resinous wax used in the hives of domesticated bees it would seem that the secretion of species of **Trigona** is very similar. An analysis of this material by **Greshoff** and **Sach** (*Pharm. Weekblad.* 47,933), however, showed that it consists of a mixture of 84 parts of resin, 12 parts of wax with 4 parts of an impurity insoluble in alcohol. The resin melted at 60° and the wax at 66°.

Propolis.

As before mentioned, the honey of the comb has a peculiar flavour and is valued by some tribes for its medicinal properties.

Adulteration.

Among these specimens were three purchased in the bazars of Simla, Rawalpindi and Sahåranpur which were decidedly adulterated or were foreign substitutions. They were called "refined wax" and differed in appearance from ordinary white wax in resembling white bar soap. In some respects it had a great resemblance to Japan wax. The specific gravity was high and the melting point much lower than bees'-wax, and on ascertaining the acid and saponification values it was found that the figures were double those of genuine wax. On applying **Fehling's** test, as recommended by **Röttger**, a precipitate resembling stearic acid separated from the diluted solution. Enquiries as to the origin of the refined wax from Sahåranpur resulted in tracing it to Bombay where it was probably imported from Europe.

It is satisfactory to record that out of 64 samples collected from different parts of India only 3 were really adulterated, or less than 5 per cent. of the total, and there is no evidence that the sophisticated wax was a native product or was manufactured in the country.

Conclusions.

From the above review of the existing information we may draw the following conclusions :—

1. Indian bees'-wax is derived from three species of bees: **Apis dorsata, A. indica and A. florea,** but chiefly from **A. dorsata.**
2. The wax separated from the combs of the three species of bee are substantially identical in composition, and is rarely mixed for fraudulent purposes.

B. 392-415.

An Account of the Bees-wax of British India.

CHEMICAL EXAMINATION.

Conclusions.

3. Indian bees'-wax differs analytically from that of Europe chiefly in its lower acid value.
4. Indian bees'-wax is procurable in large quantities, and the trade, which has remained almost stationary for the past twenty years, is capable of great expansion.

With regard to the last conclusion it may be said that much attention has been given of late to the subject of apiculture in the West Indies with very successful results. During the ten years from 1888 to 1898 the value of bees'-wax exported has increased from £4,823 to £10,389. Some share of this increase is no doubt due to the intelligent action of the Jamaica Agricultural Society in employing experts to make periodical visits to the country districts and to encouraging a better system of caring for the bees and recovering honey and wax. Another feature of success is the high class quality of the wax sent to the London market and the consequently good prices realized.

In India the industry is in the hands of almost wild tribes and the wax is refined by very primitive methods without any special regard to appearances. There is therefore in this country vast opportunities of improvement. The sources of supply might be visited and a study made of better methods for collecting the combs and preparing the wax for the market by more economical processes. Spasmodic attempts have been made in different districts to domesticate the bees, but no really satisfactory results can be shown. A closer acquaintance with the habits of the wild bees and the flowers they frequent is urgently required, and an earnest enterprise in this direction is almost sure to meet with success.

B. 392-415.

G. I. C. P. O.—No. 596 R. E. P.—4-7-1904.—2,500—P. M. M.

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series; those on Forestry in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

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